PAMPHLET 1410

Revised June 1981

GRS AUTOMATIC HIGHWAY CROSSING GATE WITH TYPE D MECHANISM

INSTALLATION, OPERATION, MAINTENANCE

GENERAL RAILWAY SIGNAL
A UNIT OF GENERAL SIGNAL

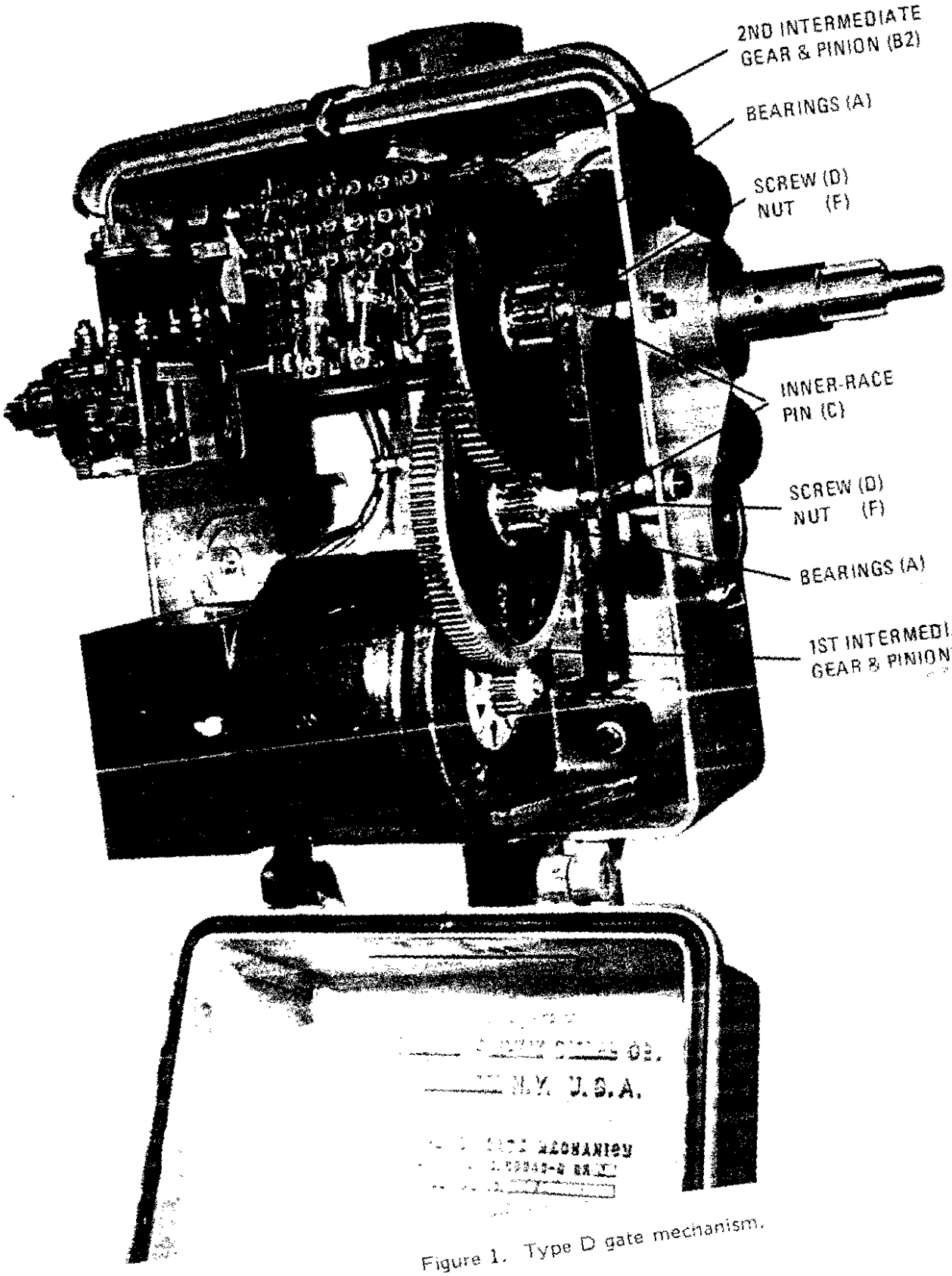

Figure 1. Type D gate mechanism.

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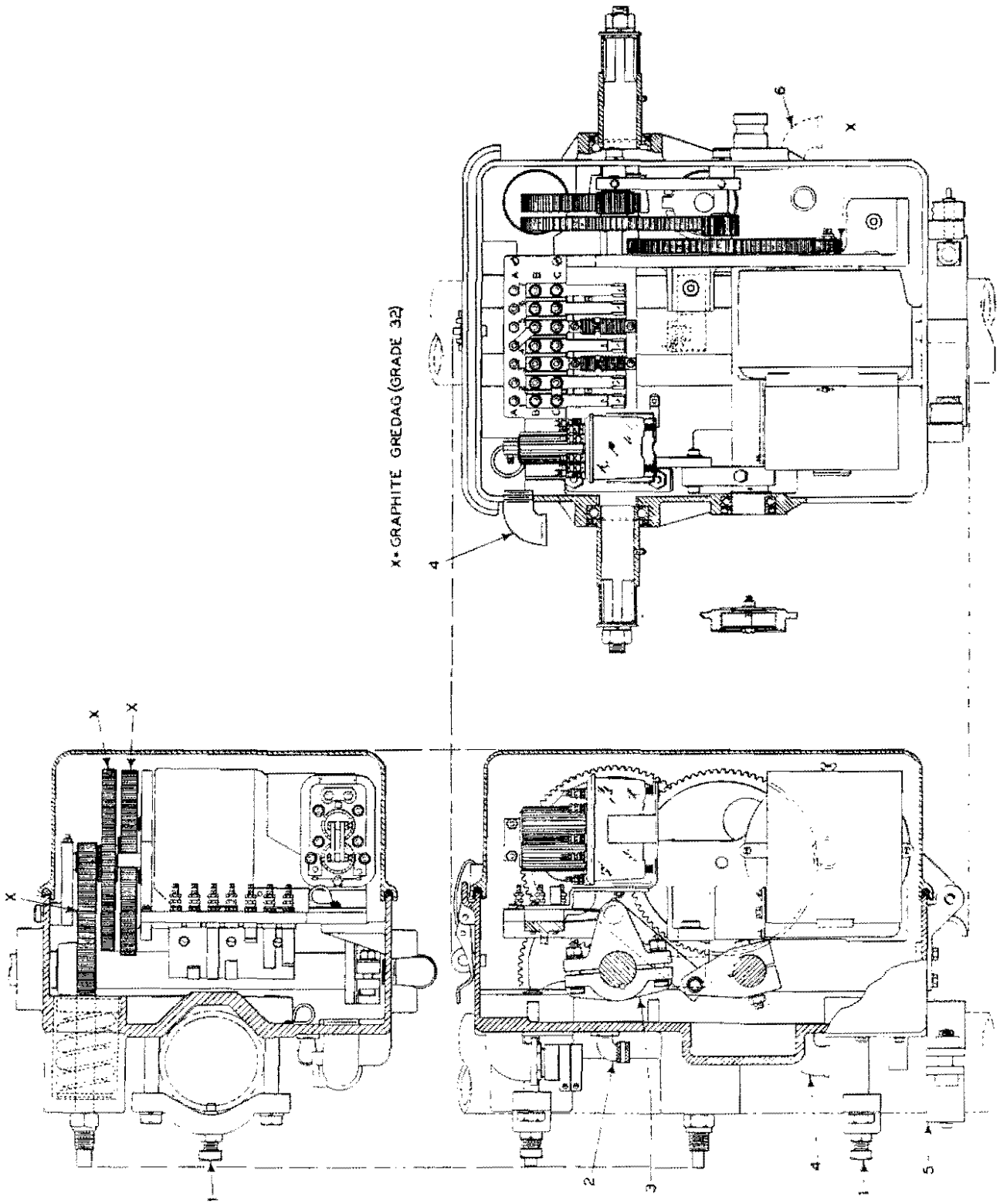


Figure 2. Assembly diagram.

INTRODUCTION

The GRS Type D automatic highway crossing gate mechanism provides reliable, high-speed operation with minimum maintenance. It is capable of handling gate arms up to 40 feet in length with a maximum clearing time of only 10 seconds.

Prelubricated, shielded or sealed bearings are used throughout the mechanism. The only lubrication required is the occasional application of grease to the gear teeth.

The mechanism operates on low voltage d-c. A motor and gear train raises the gate arm from the horizontal to the clear position. A hold-clear magnet and associated locking device, which hold the gate arm in the clear position as long as the supply energy is present, assure continuous protection. The approach of a train deenergizes the hold-clear magnet and the gate arm starts to descend by gravity. To speed initial descent and to counter unusual conditions, such as strong adverse winds, power drive is used until the gate arm descends to a position 50 degrees from horizontal. The power-down circuit is limited by a dynamic snub to prevent too fast a power descent. From this position, the counterweighted gate arm descends by gravity. At 5 degrees from horizontal, additional dynamic snubbing brings the gate arm to a gentle stop.

DESCRIPTION

The Type D crossing gate mechanism, Figures 1 and 2, consists of a four-pole d-c motor, gear train, circuit controller, and motor control relay. The gearing, motor, and circuit controller can be removed from the mechanism housing without disturbing the main gate shaft.

The cast-iron housing fastens to a 5-inch mast by means of two pole clamps. A support clamp, ref. 5, Figure 2, is provided for attaching to the mast below the housing. When the pole clamps are loosened, this clamp holds up the housing while it is rotated away from the highway during installation, adjustments, or replacement of the gate arm. Gasketing in the cast-aluminum cover prevents the entry of dust or water.

The main gate arm shaft has splined ends for mounting cast-iron supporting members. Counterweights, as well as supports for the wood and fiberglass roadway arms, are attached to these supporting members. The gate arms are purposely counterweighted so that, in the clear position, they have a strong tendency to descend by gravity to a horizontal position. This tendency to descend is expressed in foot pounds of torque. The counterweights provide the means of adjusting the horizontal and clear position (vertical) gate arm torque to accommodate gate arms from a minimum of 12 feet to a maximum of 40 feet in length.

Adjustable spring stop assemblies in the mechanism cushion the stop of the gate arm in the final horizontal position. They not only absorb any shock at the end of the travel in normal operation, but also in cases where the mechanism is suddenly stopped when moving at a higher speed.

The four-pole, one-tenth horse power, d-c motor has four field coils. When the gates are raised, the motor is series-connected with four field coils in series-multiple. When the gates are lowered, a modified shunt motor connection (power down to 50 degrees) ensures positive descent of the roadway arm against adverse wind. A spring-coupled hold-clear prevents excessive strain on the mechanism when the gate arm settles back in the clear position. It also holds the gate arm in the clear position while power is applied to the hold-clear magnet.

Contacts on a built-in motor-control relay select the direction of rotation of the motor by proper circuit connections, and also complete the snub circuit from the 50-degree position to the horizontal position.

A friction driving clutch, located on the pinion end of the motor shaft, prevents strain on the motor and mechanism should the gate arm be broken off and the gears driven by the counterweights against the vertical spring stop. The clutch is factory adjusted to slip at a motor current of approximately 20 amperes.

The heavily constructed gear train is designed for long service with no maintenance, except an occasional application of grease to the gear teeth. The motor pinion drives the first intermediate gear which, in turn, drives the second intermediate gear. This gear drives the main sector gear on the gate arm shaft. The total gear reduction between the motor shaft and the gate shaft is 222 to 1.

A circuit controller, driven by the roadway shaft, contains seven contact spaces. Four spaces are for control of the gate mechanism, two spaces are for the auxiliary circuits, such as a bell and clear position indication, and the remaining space is a spare.

A sidewalk arm is available as an option. The sidewalk arm shaft, crank-connected to the main shaft, can be readily added to the mechanism in the field, without hindering normal gate operation. Other options include a digital counter to record the number of gate operations, and a heater.

OPERATION

When a train enters the track circuit in approach to the highway crossing, the gate control relay (located outside the gate mech-

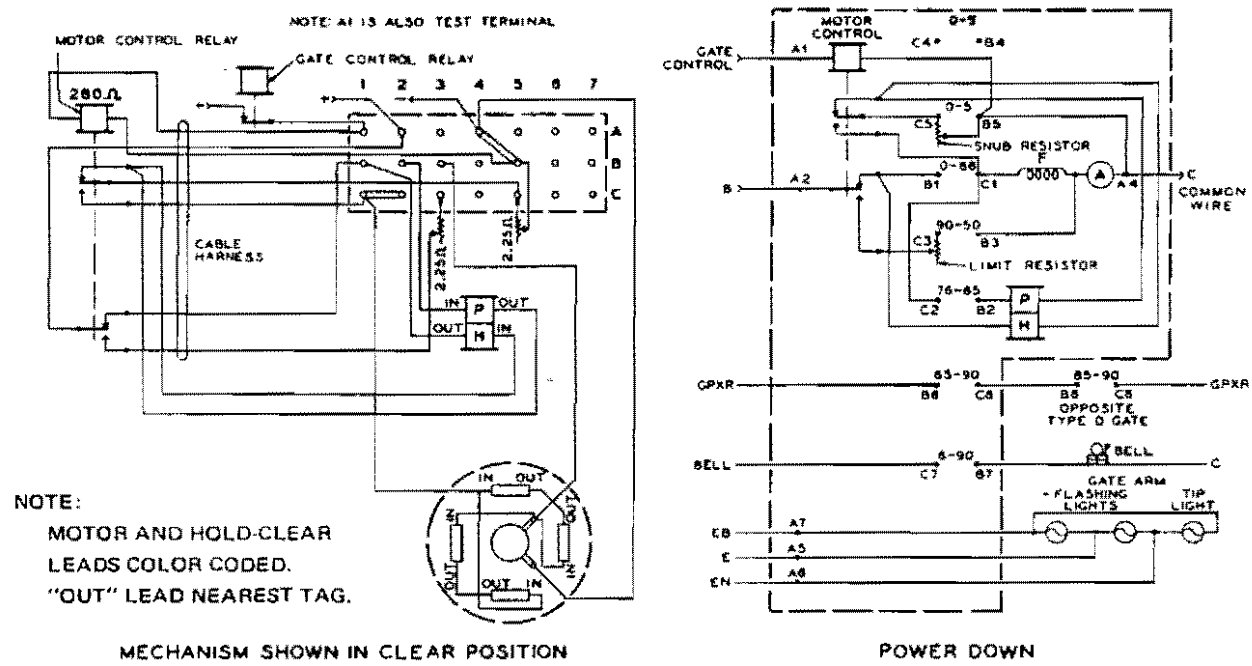


Figure 3. Internal circuit for Type D mechanism.

anism) releases, opening the circuit to the motor control relay (located inside the gate mechanism). The power-down circuit, Figure 3, is closed from B (positive energy) through terminal A2, a back contact of the motor control relay and circuit controller contact C3-B3 to a connection between the armature and field winding of the motor.

The current flows (1) through the armature to common (c) and (2) through the field, a back contact of the motor control relay, and the variable snub resistor to common. This modified shunt circuit causes the motor to assist the gravity and unbalanced torque in moving the gate arm from 90 degrees to 50 degrees against any strong winds.

As the motor accelerates, the driving current in the armature diminishes to zero and a dynamic snub current is generated by the armature which flows through the field, the back contact of the motor control relay, and the snub resistor to the armature. The snub current flows through the motor field in multiple with the external energy. This provides speed control for the descent of the arm from 90 degrees to 50 degrees, depending upon adjustment of the variable limit resistor.

At 50 degrees, controller contact C3-B3 opens, removing external energy from the drive-down circuit. The dynamic snub circuit continues to provide speed control for the descent of the arm from 50 degrees to 5 degrees depending on the adjustment of the variable snub resistor. At 5 degrees, controller contact C5-B5 shunts the variable snub resistor to reduce the speed and to provide o cushioned stop for the gate arm in the horizontal position.

After the train passes over the crossing, the motor control relay picks up, closing the up circuit from B (positive energy) through a front contact of the motor control relay, controller contact B1-C1, and the motor field and armature to negative (common) wire. This energizes the motor which clears the gate arm. High resistance winding H of the hold clear is also energized when the motor control relay picks up, but this winding alone cannot pick up the hold-clear armature.

At 76 degrees, contact B2-C2 closes, energizing hold-clear winding P. With windings H and P both energized, the hold-clear armature picks up. At 85 degrees, contact B2-C2 opens the circuit to winding P. Winding H holds the hold-clear armature up. At 88 degrees, snap contact B1-C1 opens the motor circuit and the gate is held in the clear position by the energy in the H coil.

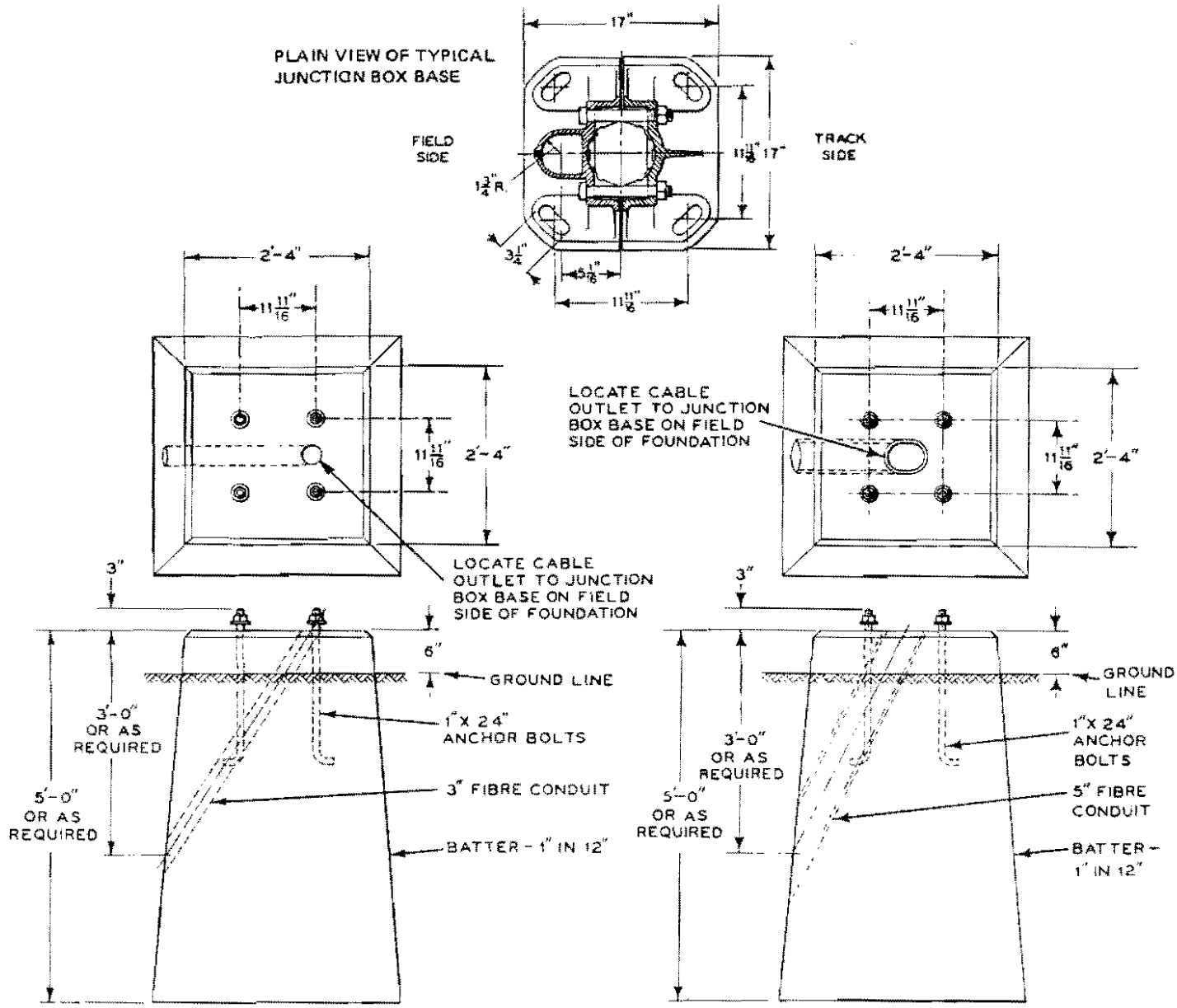


Figure 4. Foundation and base plan.

INSTALLATION AND ADJUSTMENT

Wire Size and Battery

The resistance of the energy wires used between the battery and the terminals in the gate mechanism should be not more than 0.1 ohm. Recommended wire sizes are as follows:

Distance from Battery Terminals to Mechanism Terminals	Size of Soft Drawn Copper Wire
Up to 60 Feet (120 feet of wire)	No. 9 AWG
From 60 to 120 Feet (240 feet of wire)	No. 6 AWG

The size of the battery is dependent on the length of the roadway arm. The recommended battery is as follows:

Gate Arm Length in Feet	Clear Position Torque in Foot-Pounds	Number of Cells		
		Lead	Nickel Iron	Nickel Cadmium
Up to 24	200	6	9	9
25 to 36	220 to 405	7	10	11
37 to 40	432 to 480	8	12	13

Overload Protection

Fusing is recommended to protect the mechanism against sustained overload. Connect the fuse lead to terminal A2 on the circuit controller. A 10-ampere Slo-Blo fuse is usually adequate for the longer gate arms operating under adverse conditions, such as high winds. Shorter arms generally require fuses of lower ratings, at no more than one half of the adjusted clutch slipping current.

Junction Box Base and Mast

1. A recommended concrete foundation for use with a junction box base is shown in Figure 4. When attaching the base to the foundation, be sure that the junction box and cross arm are in proper position in relation to the roadway.

2. Set the mast in the base and clamp securely.

Gate Mechanism

1. Clamp the Type D gate mechanism, Figure 5, to the mast on the side away from the roadway (so that the shaft is 5 feet, 4

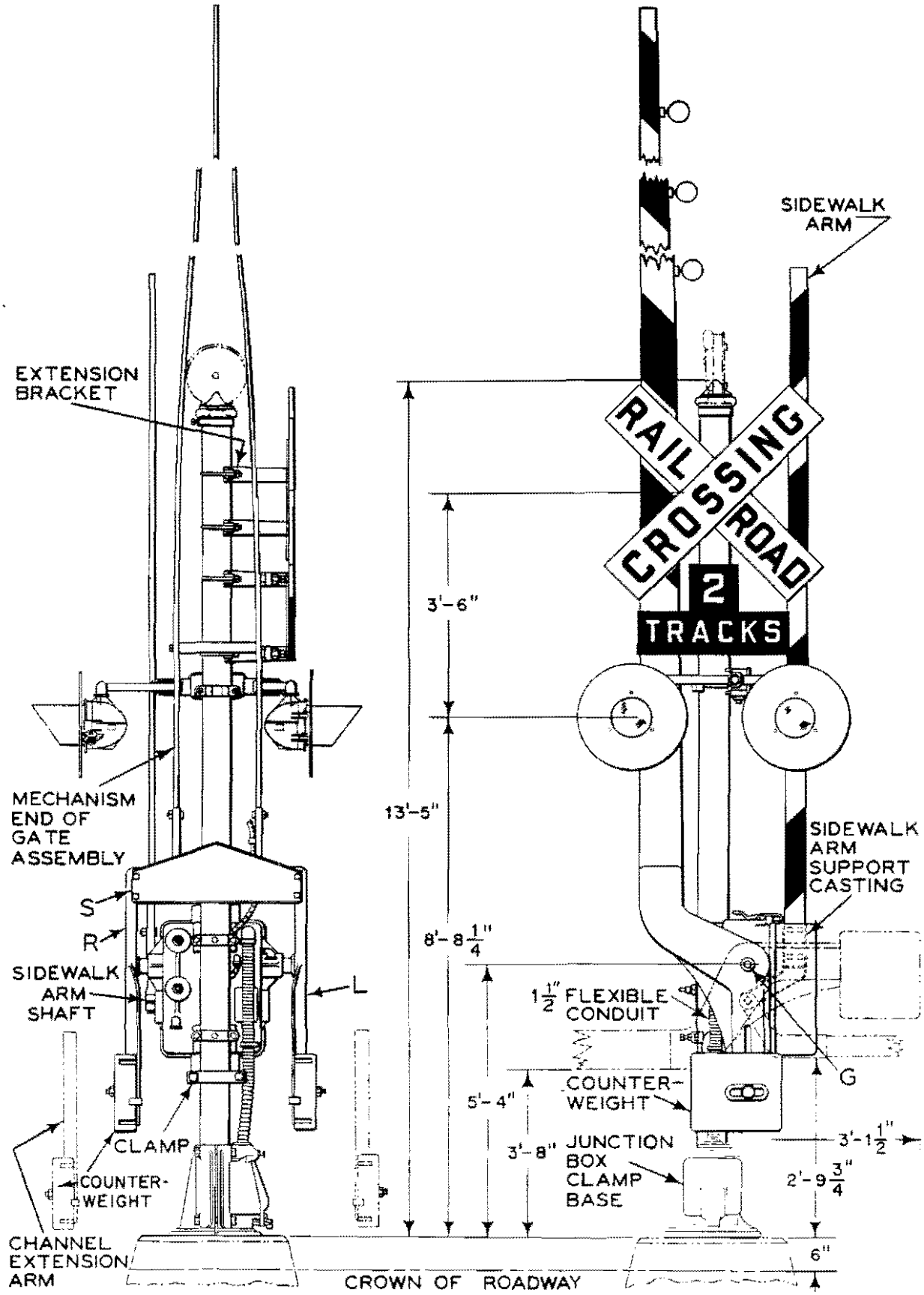


Figure 5. Automatic crossing gate.

inches above the top of the foundation) using pole clamps 1, Figure 2. The shaft should then be 5 feet, 10 inches above the crown of the roadway to bring the gate arm to the proper height.

2. Attach support clamp 5, Figure 2, to the mast and against the mechanism. Locate and drill a ½-inch diameter hole in the mast for the pin on the clamp. Loosen the pole clamps and swing the mechanism around 90 degrees so that the gate arm can be installed without blocking vehicular traffic on the crossing.

3. Remove the protective closure from the conduit outlet on the back of the mechanism case and install the 1½-inch flexible metallic conduit. Make sure that the main shaft is in the position it assumes when the gate arm is horizontal. This condition exists when gear segment D is in contact with stop screw A, as shown in Figure 10.

4. Remove the nuts and washers from the ends of gate arm shaft G, Figure 5, and apply the gate arms and counterweight support arms R and L, Figure 5, keeping the gate end in the horizontal position when applying to the shaft. Replace the washers and nuts on the ends of the main shaft, but do not tighten the nuts.

5. Apply gate support S between arms R and L, insert the bolts, apply the washers and nuts, and tighten securely.

6. Tighten the nuts on the ends of the main shaft.

7. Remove the bolts, nuts, and washers from the mechanism end of the roadway gate arm assembly. Do not apply the counterweights before the roadway gate arm is installed.

8. Slide the gate arm into the channel of support S, insert the bolts, apply the washer plates on the inner sides of the side boards, install the lock washers and nuts, and tighten securely.

NOTE: The mechanism can be equipped with a sidewalk arm shaft which has a square section extension on one side only of the mechanism case. This shaft is installed to extend from the right (track) side of the case. The sidewalk arm if used, should be applied in the horizontal position corresponding with the position of the roadway arm. Proper alignment is attained by loosening clamp 3, Figure 2, and adjusting the arm to the true horizontal. The sidewalk arm support casting should be applied before support R, Figure 5. However, do not apply the sidewalk arm until the torque has been adjusted.

Gate Arm Lights

1. Install the gate arm lights in the existing holes, using the bolts furnished. Attach the wires to the terminal blocks, leaving a proper drip loop. Apply the terminal block cover so that the slotted wire opening, facing the mechanism end of the arm, will drain with the gate arm in the clear position. Remove the plug from the wire entrance opening in the back of the case, and insert cable grip 2, Figure 2, in the tapped hole, Insert the cable, extending from the gate arm, through the cable grip.

2. Secure the cable in the connector and attach the wires to the terminal posts inside the mechanism case. If a sidewalk arm light is used, drill and tap a ½ inch pipe-threaded hole in the side of the mechanism case near the sidewalk arm shaft bearing, and install ½ inch street-ell 6, Figure 2, with the strain relief bushing. Insert the two conductor cord through the rubber bushing and pull enough cord into the case to reach the terminals. Tighten the strain relief bushing. Connect the wires to the terminals in the mechanism case to which the roadway arm tip is already connected.

Counterweights

The correct counterweights are furnished for each gate arm. For safety, have the gate arm held in a horizontal position while applying the counterweights.

Where gate arms are not more than 24 feet long, only one counterweight support arm R, Figure 5, is required. The other gate support arm L has no extension for mounting a counterweight. Where gate arms exceed 24 feet in length, two counterweights are required, and extensions are provided for mounting the counterweights on both support arm R and support arm L. Note that the length of a gate arm is measured from the center line of the mast. To attach the counterweight, proceed as follows:

1. If the gate arm is not over 24 feet long, assemble the retaining strap to one 160 pound counterweight, as shown at the right of Figure 6. Place the weight on support arm R, Figure 7, and slide it to the center of the slot. Insert the clamp washer and the 1-inch bolt, apply the washer and nut, and tighten lightly.

2. If the gate arm is 25 to 30 feet long, assemble the retaining straps to two 160 pound counterweights as shown in Figure 7. Attach the weights to their respective support arms R and L as described in step 1.

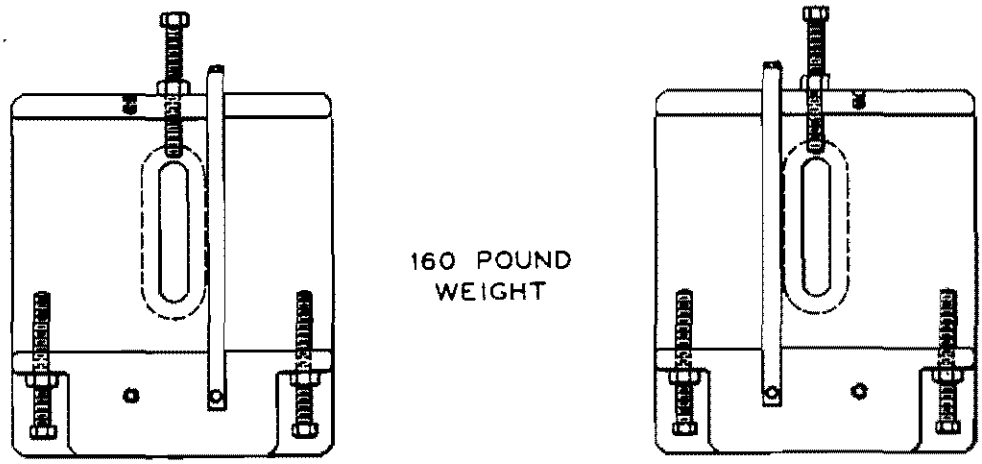


Figure 6. Counterweights.

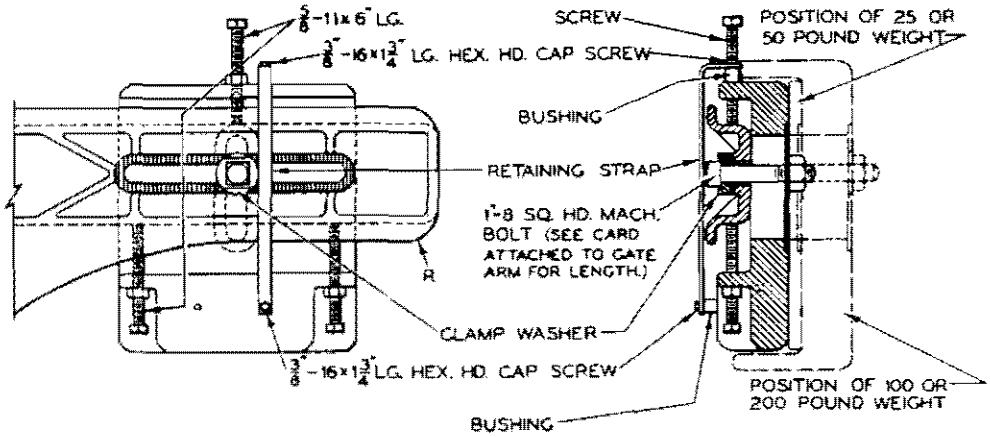


Figure 7. Assembly of counterweight to support arm.

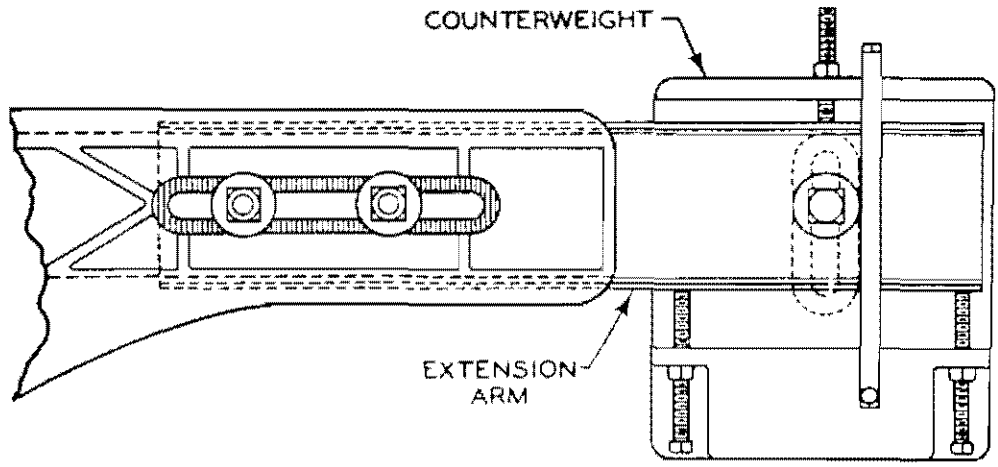


Figure 8. Extension arm for counterweight.

3. If the gate arm is 31 to 40 feet long, assemble the retaining straps as in step 2, and attach the weights to the extensions of grip arms R and L as shown in Figure 8.

NOTE: DO NOT attach the wood sidewalk arm (if used) before making the torque adjustments.

Horizontal Torque

The horizontal torque is adjusted, Figure 9, by sliding the counterweight(s) back and forth on the support arm(s), or support arm extensions, until a

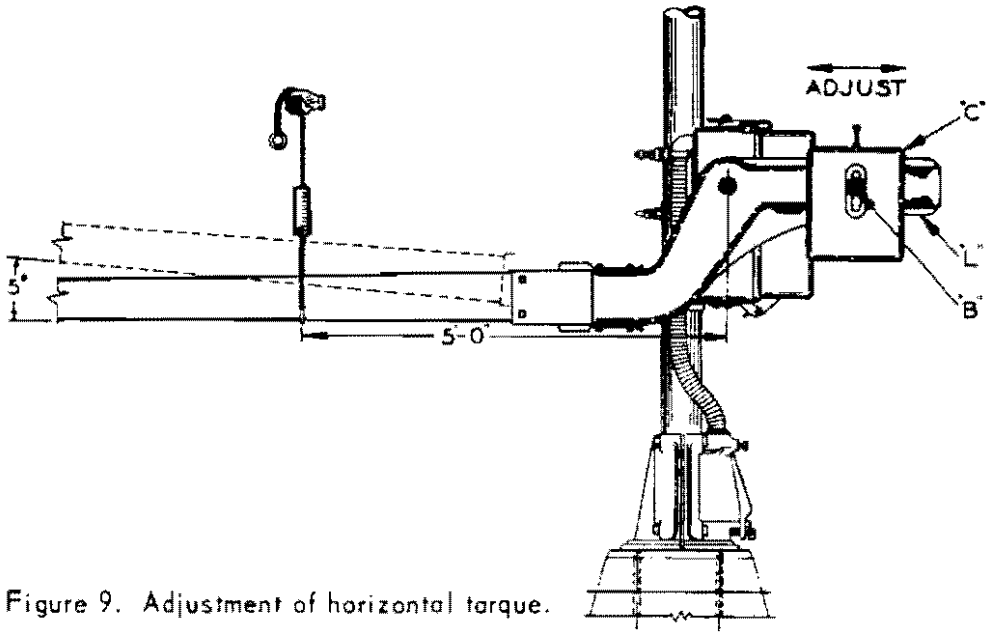


Figure 9. Adjustment of horizontal torque.

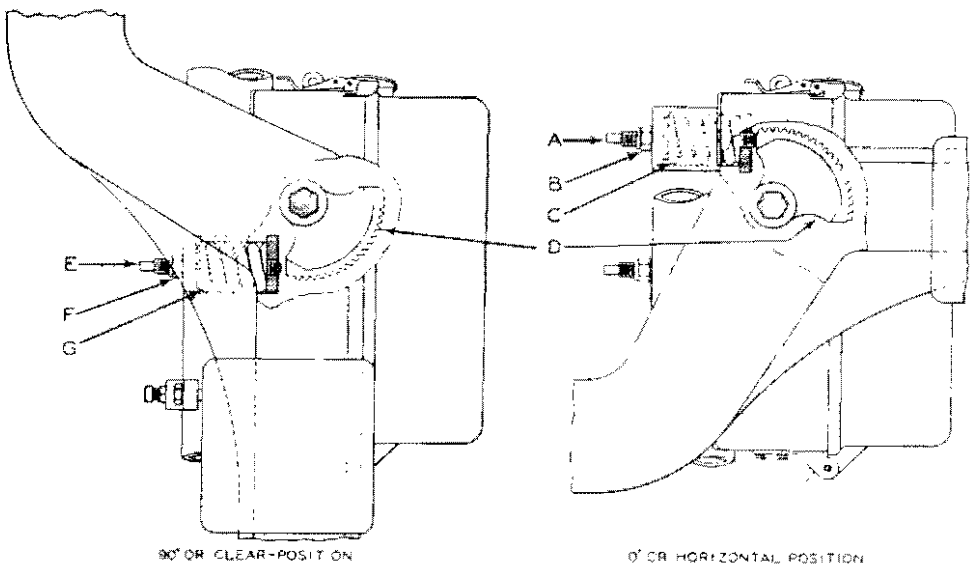


Figure 10. Spring stop assemblies.

scale (located five feet from the center of the main shaft) reads 10 pounds. Proceed as follows:

1. Loosen bolt B slightly to free the counterweight. WARNING: Do not loosen bolt B too much or the counterweight may fall off.

2. Attach the scale to the gate arm at a point 5 feet from the main shaft.

3. Raise the gate arm 5 degrees above horizontal and adjust the counterweight(s) until the scale reads 10 pounds (a torque of 50 foot-pounds).

4. After adjustment, tighten bolt B just enough to prevent the counterweight from sliding lengthwise in the slot.

An alternate method of determining correct horizontal torque is to attach a torque wrench with a 3/4 inch socket to the nut on the clutch end of the motor shaft. Adjust the counterweight(s) to give a 2.70 inch-pounds torque on the motor shaft with the gate arm 5 degrees above horizontal. If the nut rotates on the shaft, readjust the clutch per instructions on page 24. Readjustment of the clutch may be delayed until after the clear-position torque has been adjusted.

Spring Stops

1. Adjust the horizontal spring stop, Figure 10 - initial tension is adjusted at the factory by compressing spring C by means of elastic stop nut B. For field adjustment, hold nut B with a wrench to prevent its turning, and with a second wrench turn screw A in or out as required to locate the gate arm in the horizontal position.

2. Adjust the clear position spring stop, Figure 10. Raise the gate arm by power to the clear position (90 degrees) and hold it in this position. The initial tension of spring G is adjusted at the factory. Hold nut F with a wrench and with a second wrench turn screw E in or out until there is approximately 1/8-inch clearance between gear segment D and the end of the stop screw E. Power-operate the mechanism to check the adjustment.

   NOTE: For gate arms exposed to high winds, etc., which compress the spring too much, preload the spring by holding the screw and turning the nut, then repeat the adjustment.

Clear-Position Torque

The clear-position torque, Figure 11, is adjusted, with the gate arm in the clear (vertical) position, by shifting the counterweight(s) back and forth on the support arm(s), or support arm extensions, until a scale (attached to the mast) indicates the proper value as shown in Figure 12.

NOTE: Do not attach the wood sidewalk arm (if used) before making the torque adjustment.

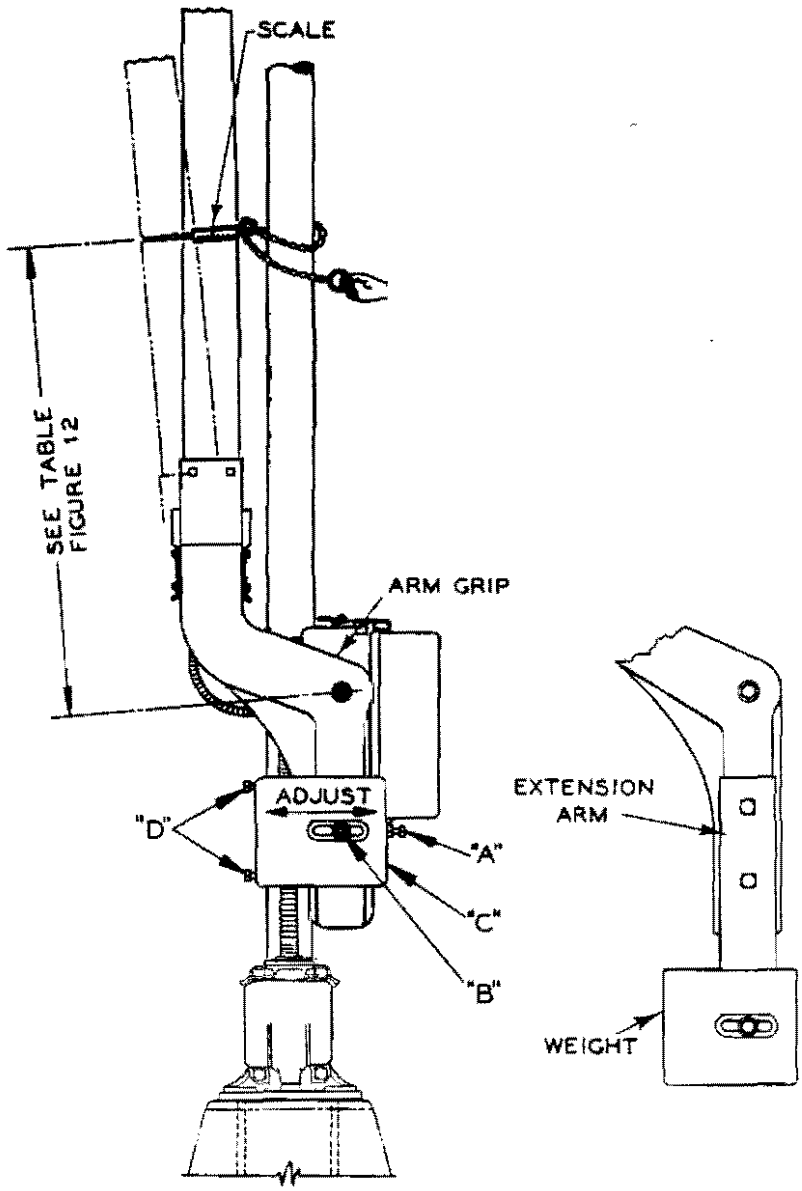
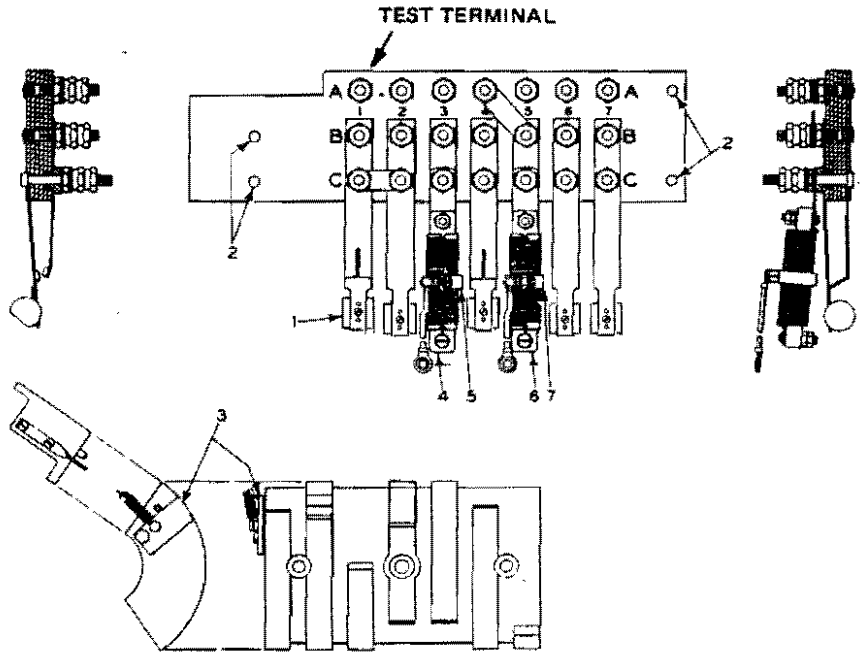


Figure 11. Adjustment of clear-position torque.

	Gate Arm Length (Feet)	Gravity Torque in Clear Position (Foot-Lbs.)	Scale Reading (Lbs.)	Distance X Feet	Approx. Lbs. of Counter-weight, Total (See Note)	Nominal Volts	Max. Amps To Clear Under Normal Conditions	Torque on motor shaft in inch-pounds
Mount weights on one arm only	14	200	40	5	160	12	8.2	11
	15	200	40	5	160	12	8.2	11
	16	200	40	5	185	12	8.2	11
	17	200	40	5	210	12	8.2	11
	18	200	40	5	235	12	8.2	11
	19	200	40	5	260	12	8.2	11
	20	200	40	5	260	12	8.2	11
	21	200	40	5	285	12	8.2	11
	22	200	40	5	285	12	8.2	11
	23	200	40	5	310	12	8.2	11
	24	200	40	5	360	12	8.2	11
Mount weights on both arms	25	220	44	5	370	14	8.7	12
	26	240	48	5	395	14	9.0	13
	27	250	50	5	420	14	9.3	14
	28	266	38	7	470	14	9.7	15
	29	280	40	7	520	14	10.0	16
	30	301	43	7	620	14	10.4	17
Mount weights on both extension arms	31	308	44	7	395	14	10.8	18
	32	315	45	7	420	14	11.3	18
	33	343	49	7	445	14	11.8	19
	34	369	41	9	470	14	12.1	20
	35	387	43	9	495	14	12.5	21
	36	405	45	9	520	14	13.1	22
	37	432	48	9	545	16	13.8	23
	38	450	50	9	570	16	14.1	24
	39	470	47	10	595	16	14.4	25
	40	480	48	10	620	16	14.8	26

NOTE: Will vary somewhat with weight of gate arm and lights. Extensions on counterweight arms of gates 31-to 40-feet long reduce the weight required.

Figure 12. Table of clear-position torque values.



Contact Space No.	Function of Contact	Operation of Contact
1	Up motor cutout	Opens at gate clear
2	Hold-clear contact	Closes near gate clear
3	Down motor contact	Closed from gate clear to halfway down
4	Down indication	Closes near gate down
5	Snub resistance shunt	Closes near gate down
6	GPXR control	Closes near gate up
7	Bell control	Opens near gate down

Figure 13. Circuit controller functions and operations.

To adjust the clear-position torque, proceed as follows:

1. Operate the gate to the clear position (90 degrees) where it is held by the hold clear.

2. Attach the scale at the point indicated in the table, Figure 12.

3. Open the motor and hold-clear circuits, which causes the gate arm to fall about 5-degrees against the scale chain. Read the scale and compare with the table.

4. If adjustment is required, loosen the nut on bolt B, Figure 11, slightly. Shift counterweight(s) C by means of bolts A and D until the scale reading is correct.

5. After adjusting, secure all bolts and close the motor and hold-clear circuits.

An alternate method of determining correct clear-position torque is to attach a torque wrench with a 3/4 inch socket to the nut on the clutch end of the motor shaft after operating the gate to the clear position (90 degrees) where it is held by the hold clear. Open the motor and hold-clear circuits, which causes the gate arm to fall, and measure torque with the gate arm about 5 degrees from vertical. Adjust the counterweight(s) to achieve the correct torque per the chart in Figure 12. If the nut rotates on the shaft, readjust the clutch per instructions on page 24.

Motor Cutout

Adjust the motor cutout. Operate the gate by power to the clear position. If the gate arm does not stop at the correct position, adjust the motor cutout contact, Figure 13, by shifting the lifter on finger 1 in space 1 up, if the gate is driving past 90 degrees, or down, if the gate is driving to less than 90 degrees. After adjustment, recheck the motor cutout and clear-position spring stop.

Descending Time

The descending time is adjusted by resistors located on the circuit controller, Figure 13. The gate arm is power-driven down to 50 degrees and then descends by gravity to the horizontal position.

The power-down descending time may be increased by moving strap 5 down on resistor 4 in space 3. The gravity-down descending time may be increased by moving strap 7 down on resistor 6 in space 5. Be sure that the slide contacts bear evenly on the resistor windings and that the lock nuts are securely tightened.

The normal descending time should be between 10 and 15 seconds. Long gate arms usually operate somewhat slower than short arms. However, arms of unequal length at the same crossing can be adjusted to descend at equal rates.

Hold-Clear Release

Check the release of the hold-clear device with a voltmeter and resistance slide. The release voltage must never be less than 2.5 volts.

Clearing Time

The gate mechanisms are factory adjusted to clear a 28 foot gate arm in seven seconds at 14 volts. Descending time is factory adjusted at 10 to 15 seconds.

The clearing time varies, depending upon the length of the gate arm and other factors. Clearing times are as shown in the following table:

Gate Arm Length In Feet	Clearing Time In Seconds
Up to 24	6
25 to 36	6 to 8
37 to 40	8 to 10

If the gate arm does not clear, check for clutch slippage. The clutch may be adjusted to slip at a motor current of up to 30 amperes to accomodate adverse winds and sleet loads on long arms. The adjustment procedure is described under "Clutch" on a following page.

Miscellaneous Units

1. Install the flashing light junction box crossarm on the mast and attach the flashing light units. For alignment of 8" LEX-C flashers, see GRS Folder 254; for 12" LEX-C flashers, see GRS Folder 267.

2. Install the signs. Attach the adapter clamps to the signs using the long bolt and aluminum spacer. Attach the adapter clamps to the mast with the "U" bolts furnished with the signs.

3. Place the bell, cap or pinnacle on top of the mast. Position the bell with the gong parallel with the roadway as shown in Figure 5; thus, the sound thrown out by the edge of the gong is strongest parallel with the roadwoy.

Final Inspection

Check that the gears are clean and sufficiently lubricated. Wipe the hold-clear armature (reference 9, Figure 14) and pole faces with a

clean, dry cloth to ensure that they are free of all dirt, oil and grease. Check that the armature fits squarely against the pins in the pole pieces of the hold-clear coils. If necessary, carefully bend the hold-clear armature to achieve a proper fit. If it is necessary to bend the armature, check that the mechanism is properly adjusted as described on a following page under "Hold-Clear Mechanism".

Remove the tape from the one-inch screened street-ell ventilators, reference 4, Figure 2.

Check that there are no unpainted or unplated steel surfaces. If necessary, apply a light film of anti-rust material to such surfaces.

MAINTENANCE

Care should be exercised to protect all parts of the mechanism against exposure, and also to prevent foreign substances from getting into parts where there is a possibility of interfering with the proper action of the mechanism. Check that there is no oil, grease, or dirt on the armature or pole faces of the hold-clear magnet.

When it is necessary to replace a gate arm or work on the mechanism, loosen the mechanism case clamps, remove the conduit outlet on the junction box base, and swing the mechanism parallel to the roadway. Be sure to open the motor control circuit before working on the mechanism.

Gate Arm Torque

Check the gate arm torque adjustment each time that any change is made in the gate arm, the location of a gate light, or other alterations affecting the total weight of the assembly.

Maintain the gate arm position adjustments to avoid ill-appearance of a drooping gate arm when down, and to avoid the possibility of travel beyond the desired clear position where the gate arm or arm lights may strike the mast or other parts of the assembly.

Electrical Tests

Make electrical tests at regular intervals. When testing the mechanism, open the gate control energy at test terminals A1 on the circuit controller, Figure 13. If it is desired to have the gate arm descend without power, insert a piece of paper between the contacts in space 3.

Lubrication

The double-sealed bearings in the motor and gate mechanism do not

require periodic lubrication. Every 20,000 operations or every 6 months, whichever occurs first, grease the gear teeth with Molykote G-N (GRS No. 91A0001) and lightly grease the lobes of the circuit controller commutator with a lithium base low temperature grease, such as Lubriplate MAG-1.

Circuit Controller

The circuit controller contact assembly is attached to the mechanism frame by four fillister head screws 2, Figure 13.

The circuit controller commutator is fastened to and operated by the rotation of the roadway arm shaft. All contact openings are factory adjusted as follows:

Contact Number	Contact Opening Adjusted to
1	.065" to .090"
2	.015" to .050"*
3 thru 7	.050" to .070"

*Minimum opening preferred.

Dog 3, Figure 13, should be flush with or slightly below the surface of the commutator. Contacts should have noticeable wipe to cut frost and tarnish.

The motor control contact in space 1 is a snap contact which cuts off motor energy when the gate reaches the clear position. If power is interrupted momentarily or if force on the gate arm makes the gate start down, the following happens in this order:

1. The gate drops until lifter 1 meets the raised part of cam lobe 1.

2. Snap dog 3 snaps under lifter 1.

3. The gate starts back up and the hold-clear armature picks up.

If the hold-clear armature picks up too soon, check the hold-clear mechanism operating voltage, as described under "Hold-Clear Mechanism".

If the gate arm goes to the clear position and releases the hold-clear armature, check that there is space between the sector gear and the clear position spring stop. Adjust the spring stop if necessary, as described previously under "Spring Stops". Also check that the nut on the left end of the motor shaft is not clamping the adjacent spiral spring. Back off the nut ½ turn if necessary.

Motor-Commutator and Brushes

The pressure of the brushes on the commutator is factory adjusted to between 13 and 17 ounces and remains such throughout the life of the brushes.

Do not leave the brushes in service until the motor fails. Replace them when the distance from the commutator to the closest point on the brush holder is approximately ¼-inch. Check that the brush holder is properly positioned and does not contact the commutator.

Brushes in new mechanisms are fitted so that at least 75% of the brush is in contact with the commutator. When replacing brushes, at least 75% of the replacement brush should be in contact with the commutator. Use #0 sand or garnet paper for the roughing operation and finish with #3/0 sand or garnet paper.

Normally, the commutator has a glossy coffee color. If the gate is working properly, do not attempt to clean the commutator, only remove any accumulated carbon dust. If the commutator needs cleaning, use a lint-free cloth moistened, but not saturated, with oil. Be sure to wipe the commutator dry afterward.

Hold-Clear Mechanism

All moving parts should have appreciable end play in their respective supports.

With hold-clear armature 9 picked up, Figure 14, the tip of dog 2 should clear the bottom or root of the ratchet step on the rim of hold-

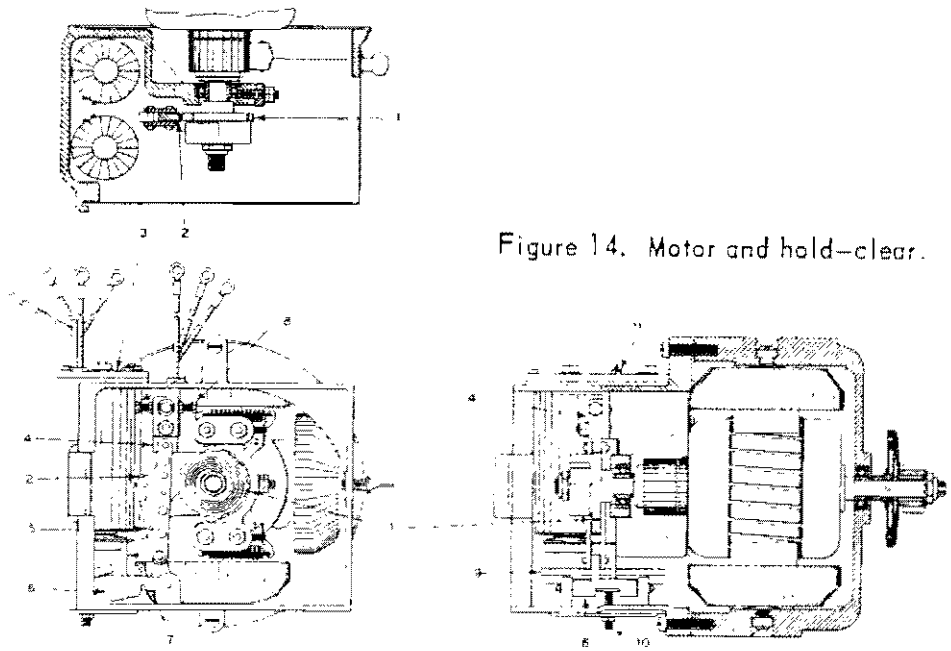


Figure 14. Motor and hold-clear.

clear disc 1, by no less than 0.010 inch. If adjustment is required, loosen screws 8 and adjust hanger block 4 which supports link 5.

With hold-clear armature 9 in its deenergized position, the clearance between the tip of dog 2 and the holding notch of hold-clear disc 1 should be no less than 0.025 inch. This adjustment is made by adjusting stop 10 as required.

Both pick-up (low-resistance) winding P, Figure 3, and hold (high-resistance) winding H, are used to pick up hold-clear armature 9, Figure 14. The hold-clear armature should pick up when 7.5 to 8.5 volts is applied to both the pickup and holding windings. The pickup winding opens near the clear position, leaving only the holding winding energized. The dropaway voltage for any length arm should not be less than 2.5 volts.

The release voltage of the hold-clear magnet should not be less than 2.5 volts. The release voltage may be increased by rotating adjusting rod 7, assembled in hold-clear magnet yoke 3, downward until it bears on hold-clear armature support 6. After adjustment, tighten nut 11 on adjusting rod 7 carefully to avoid stripping the threads.

Clutch

The friction driving clutch, located on the pinion end of the motor shaft, is factory adjusted to slip at a motor current of approximately 20 amperes. This permits clearing the longest gate arm under most conditions. The clutch slipping current may be changed to meet specific requirements.

To ensure proper operation during routine maintenance, check the clutch adjustment as follows:

1. Disconnect the positive motor lead from terminal A2; see Figure 3.

2. Connect an ammeter capable of measuring 0 to 30 amperes between terminal A2 and the motor lead.

3. Connect a jumper between terminals B1 and C1.

4. While observing the ammeter, operate the gate mechanism to the clear position. When the gate reaches the clear position, the desired reading should be observed. If a correct reading is observed, proceed to step 8; if not, proceed to step 5.

5. Disconnect the jumper between terminals B1 and C1.

6. If the reading obtained in step 4 was too high, turn the elastic stop nut (reference 12, Figure 14) counterclockwise; if the reading was too low, turn the nut clockwise.

7. Reconnect the jumper between terminals B1 and C1. Repeat steps 4, 5, and 6 until the desired reading is obtained. Clutch slipping current will vary slightly with the weather and temperature of the clutch. Excessive slipping will cause the fuse, if any, to open the power circuit.

   NOTE: Do not adjust the clutch for a slippage current in excess of 30 amperes. Only 16 amperes is required to clear a 40-foot gate arm under windless conditions; shorter gate arms require even less current under the same conditions.

8. Disconnect the jumper and reconnect the motor lead to terminals A2.

Bearings, Gears, and Inner-race Pins

Referring to Figure 1, bearings A, gears B1 and B2, and inner-race pins C require no maintenance other than occasional lubrication of the gears. However, to ensure correct, trouble-free operation, inspect these parts whenever periodic maintenance is scheduled.

Lower the mechanism cover and visually inspect the gears, gear teeth, and bearings. If excessive wear or broken gear teeth are observed, replace gears B1 (GRS No. 23410) and B2 (23410-6), bearings (GRS No. 49536-98), and inner-race pins (GRS No. 504-424) as described in the numbered steps below.

Operate the gate mechanism several times. While the gate is operating, check that the gears do not bind. Listen closely to the gears and bearings for any grating sounds; if a grating sound is heard, replace the bearings and inner-race pins as described below. Replace the inner-race pin every 500,000 gate operations and/or when replacing bearings.

To replace the gears, bearings, or inner-race pin, proceed as follows:

1. Lower the mechanism cover.

2. Remove the load from the gears by either lowering the gate arm to its full down position or by fastening the gate arm in its clear position. Rotate the gears by hand. If backlash in the gear's mesh is present, the gears are unloaded.

3. Remove the control energy from the mechanism.

4. Referring to Figure 1, loosen nut(s) F, and unscrew screw(s) D, three complete turns. Note the relative locations of the spacers and washers.

5. While holding gear B (CAUTION - the gear weighs 11 lbs.), remove inner-race pin C.

6. Remove the gear from the mechanism.

7. If necessary, replace the gears, bearings, and/or inner-race pins. If replacing bearings, check that they have been thoroughly factory greased. Protect the bearings against any dirt until the inner-race pin is inserted. Before inserting the inner-race pin, oil it lightly with GRS MS2-50 or an equivalent high quality light machine oil.

8. Reassemble the mechanism placing the spacers and washers as before. Firmly tighten screw(s) D and nut(s) F.

9. Lubricate the gears and circuit controller commutator as described under "Lubrication" in this section.

10. Restore operating power and operate the mechanism several times to make sure it is operating properly.

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